

PROGRAMMABLE SYSTEMS AND DEVICES WITH MULTIPLEXER CIRCUITS  
PROVIDING ENHANCED CAPABILITIES FOR TRIPLE MODULAR REDUNDANCY

ABSTRACT

Programmable systems and devices that include programmable multiplexers designed to minimize the impact of single event upsets (SEUs) on triple modular redundancy (TMR) circuits. In a programmable routing multiplexer, each path through the multiplexer is controlled by a different configuration memory cell. A unidirectional buffer is included on each routing path through the multiplexer. Therefore, an SEU changing the state of any single memory cell does not short together any two input terminals of the multiplexer. Hence, when a TMR circuit is implemented using the multiplexer, an SEU affecting the multiplexer causes no more than one TMR module to become defective. The other two TMR modules together provide the correct output signal, outvoting the defective module, and the circuit continues to operate correctly.